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DEFENCE R&D DÉFENSE

FINAL REPORT AND USER'S MANUAL FOR MODIFICATIONS TO PLTPWR, DISP, DISPX, AND PROPWR

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Contractor Report

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Defence Research Establishment Atlantic

Contractor Report

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104-07014/

Abstract

This contractor report describes modifications made to the DREA programs PLTPWR, DISP, DISPX and PROPWR. PLTPWR is a program for plotting spectral data. The changes made to PLTPWR included correction of some program errors, the addition of the ability to display plots on an X terminal, and modification of the software so that it can operate under both the VMS and UNIX operating systems (i.e., on both DEC AXP and SGI computers).

DISP and DISPX are programs for plotting time series data. The ability to produce decibel plots was added to these programs. PROPWR is a program for processing power spectrum files. Additions made to PROPWR were the ability to display plots on an X terminal, tracking of lines whose frequency position varies with time, and other methods of estimating background noise.

Résumé

Ce rapport d'entrepreneur décrit les modifications apportées aux programmes PLTPWR, DISP, DISPX et PROPWR du CRDA. Le programme PLTPWR sert à tracer des données spectrales; les modifications qui lui ont été apportées comprennent la correction de certaines erreurs, l'ajout de la capacité d'affichage des tracés sur un terminal X et la modification du logiciel, de sorte qu'il puisse tourner autant avec le système d'exploitation VMS qu'avec UNIX (c'est-à-dire aussi bien sur les ordinateurs DEC AXP que SGI).

Les programmes DISP et DISPX servent à tracer des données de séries temporelles. La capacité de produire des tracés en décibels a été ajoutée à ces programmes. PROPWR sert à traiter des fichiers de spectre de puissance. Les ajouts apportés à ce dernier programme sont la capacité d'afficher des tracés sur un terminal X, le suivi de lignes dont la position fréquentielle varie dans le temps et d'autres méthodes permettant d'estimer le bruit de fond.

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Executive summary

Introduction and Background

The following four signal processing and display programs have been in general use at DREA for several years:

PLTPWR: organizes, displays and plots a selection of power spectra or grey scale diagrams generated by the general purpose signal analysis program PRODAT

DISP: displays and plots one or more time series at arbitrary time resolution (the digital equivalent to an analog chart recorder);

DISPX: a version of DISP that operates in an X-windows environment;

PROPWR: a) generates and displays one-third octave bands from power spectral data, b) generates and displays time series data extracted from time-varying narrowband acoustic signals.

Though plagued by several minor problems and limitations, these programs have continued to play an essential role in advancing acoustical research. However, recent updates to the software have resolved these difficulties, increasing both stability and robustness while adding new functionality. This contractor's report describes how to use these new features.

Results

This report catalogues the various modifications that were made to the programs PLTPWR, DISP, DISPX, and PROPWR. In addition to correcting minor bugs within these programs, the changes add extra functionality, such as the ability to operate on SGI computers and display plots on an X terminal with PLTPWR and PROPWR.

Significance

This document teaches experienced users of these programs to take advantage of the additional power and convenience made available to them in the new version of this software. However, it is important to note that this manual should be used in conjunction with existing user manuals. The author assumes the reader is already familiar with the software and does not document previously existing features in any significant detail.

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Sommaire

Introduction et antécédents

Les quatre programmes de traitement de signaux et d'affichage qui suivent sont d'usage général au CRDA depuis plusieurs années :

PLTPWR : organise, affiche et trace une sélection de spectres de puissance ou de diagrammes à échelle de gris produits par le programme d'analyse de signaux d'usage général PRODAT;

DISP : affiche et trace une ou plusieurs séries temporelles avec une résolution temporelle arbitraire (équivalent numérique d'un enregistreur analogique à bande);

DISPX : est une version du programme DISP fonctionnant dans un environnement à X fenêtres;

PROPWR : a) génère et affiche des bandes d'un tiers d'octave à partir de données de spectre de puissance; b) génère et affiche des données de séries temporelles extraites de signaux acoustiques à bande étroite variant dans le temps.

Bien que présentant divers problèmes mineurs et certaines limitations, ces programmes ont continuellement joué un rôle essentiel pour l'avancement de la recherche en acoustique. De récentes mises à jour du logiciel ont résolu ces difficultés et augmenté tant la stabilité que la robustesse, tout en ajoutant de nouvelles fonctions. Ce rapport d'entrepreneur décrit comment utiliser les nouvelles fonctions.

Résultats

Ce rapport recense les diverses modifications qui ont été apportées aux programmes PLTPWR, DISP, DISPX et PROPWR. En plus de corriger des bogues mineurs dans ces programmes, les modifications ont ajouté de nouvelles fonctions, comme la possibilité de fonctionner sur des ordinateurs SGI et d'afficher des tracés sur un terminal X utilisant les programmes PLTPWR et PROPWR.

Importance

Ce document enseigne aux utilisateurs expérimentés de ces programmes comment bénéficier pleinement de la puissance et de la commodité accrues que la nouvelle version du logiciel met à leur disposition. Il est important de remarquer que ce nouveau manuel doit être utilisé avec les manuels existants d'utilisateur. L'auteur suppose que le lecteur connaît déjà bien le logiciel et ne détaille donc pas les fonctions qui existaient déjà.

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I. GENERAL MODIFICATIONS

PLTPWR and PROPWR were modified to use the PGPLOT graphics package so that they could display plots on an X terminal. DISPX already used the PGPLOT package.

1. Running the Programs

1.1 Environment Variables

VMS

The logical names PGPLOT_DIR and GRPSHR must be defined. This can be done via the following DCL command:

@PS_72:[CHANG.PGPLOT.AXP]DREA_LOGICAL

One can optionally define the PGPLOT X window width via the following DCL command:

DEFINE PGPLOT_XW_WIDTH number

where "number" is a fraction (<= 1.0) of the screen width. This command should be entered before the program starts the PGPLOT X window server pgxwin. If pgxwin is already running, the user should close it before defining PGPLOT_XW_WIDTH.

One may wish to add the above command(s) to their LOGIN.COM file.

IRIX (UNIX)

The environment variable PGPLOT_DIR must be defined as per the following command(s):

csh or tcsh:

setenv PGPLOT_DIR /usr/people/chang/PGPLOT/pgplot/

sh:

PGPLOT_DIR="/usr/people/chang/PGPLOT/pgplot/"; export PGPLOT_DIR

One can optionally define the PGPLOT X window width via the following command(s):

csh or tcsh:

setenv PGPLOT_XW_WIDTH number

sh:

PGPLOT_XW_WIDTH="number"; export PGPLOT_XW_WIDTH

where "number" is a fraction (<= 1.0) of the screen width. This command should be entered before the program starts the PGPLOT X window server pgxwin. If pgxwin is already running, the user should close it before defining PGPLOT_XW_WIDTH.

One may wish to add the above command(s) to their cshrc or .login file.

It is possible to change other aspects of the X window display via a resource file. The user is referred to the following web page for further details:

http://astro.caltech.edu/~tjp/pgplot/xwdriv.html

1.2 Tektronix Terminal Set-up

Tektronix terminals or emulators sometimes allow several options for the graphic input (GIN) terminator. PLTPWR, DISPX and PROPWR require the GIN terminator to be either a carriage return (CR) or else none.

1.3 VersaTerm-PRO Set-Up

The VersaTerm-PRO terminal emulator can mimic either a Tektronix 4105 or 4014 terminal. A difference between the two emulations is that 4105 mode has separate graphics and text planes, whereas 4014 mode doesn't. To select the appropriate graphics mode prior to running the programs, click on either "Emulation - Tek 4105" or "Emulation - Tek 4014", and then click on "Emulation - DEC VT220".

1.3.1 Tektronix 4014 Emulation

Here are the appropriate settings for using VersaTerm-PRO Tektronix 4014 emulation with the programs:

Table 1. *Tektronix 4014 Emulation.*

MENU ITEM	OPTIONS TO SELECT
Settings – Extras	• Check "Auto Tek 4014 Entry" • Check "Auto DEC VT220"
Emulation - Tek4014	• Under "Dialog Options": • Check "Enabled dialog".
Emulation - Tek4014 - Graphic Input ...	In the resultant input box: • Mouse click - Click the "space" (vs. auto) radio button.

Emulation - Tek4014 - Graphic Input ... (cont'd)	• GIN terminator - Either click the "text" radio button and enter "^M" (carriage return) in the edit field, or else click the "none" button.

1.3.2 Tektronix 4105 Emulation

Here are the appropriate settings for using VersaTerm-PRO Tektronix 4105 emulation with the programs (N.B. - it is recommended that one use 4014 emulation rather than 4105 emulation in DISPX):

***Table 2.** Settings for VersaTerm-PRO Tektronix 4105 emulation.*

MENU ITEM	OPTIONS TO SELECT
Settings – Extras	• Check "Auto Tek 4014 Entry" • Check "Auto DEC VT 220 Entry"
Emulation – Tek4105	Under "Dialog Options" • Check "Enabled dialog". • Uncheck "Visible dialog". • (These settings cause the text • window to be used as a dialog plane)
Emulation – Tek4105 – Graphic Input...	In the resultant input box: • Mouse click - Click the "space" (vs. auto) radio button. • GIN terminator - Either click the "text" radio button and enter "^M" (carriage return) in the edit field, or else click the "none" button.

1.4 VT240/330/340 Set-Up

Before using a VT240/330/340 terminal or emulator with the programs, ensure that the "Graphics Set-Up" is as follows:

Graphics Cursor: enabled
401X GIN Terminator: CR or none

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II. PLTPWR MODIFICATIONS

PLTPWR is a program for producing on-screen and hardcopy plots of spectral data (Farrell, 1992). The changes made to this program included:

1. Some program errors were corrected.
2. The ability to display plots on an X terminal was added.
3. The software was modified so that it could run under both the VMS and UNIX (IRIX) operating systems (i.e., on both DEC AXP and SGI computers).

The starting point for the software modifications was a version of PLTPWR that had been ported to the MAXION platform (Murray, 1997). The MAXION version differed from the original AXP/VMS version in these main respects:

1. The disk I/O routines had been replaced with some portable ones.
2. The Tektronix graphics software had been modified for use on a UNIX platform.
3. The greyscaling hardcopy facility had been replaced with one used in program PRODAT.

This version of PLTPWR was usable on an SGI platform, but it had some problems. For example:

1. Carriage control handling was imperfect, which resulted in extraneous plus signs being displayed at various locations on the terminal screen.
2. Switching of the terminal between VT100 mode and Tektronix mode (and vice versa) sometimes had to be done manually.
3. Stray lines occasionally appeared when characters were plotted.

1. ERROR CORRECTIONS

Several PLTPWR errors were found and corrected:

A. The SASIO program GENCOM, which generated a SASIO command table subroutine for PLTPWR, did not work properly.

B. If one requested more input channels than were present in an input file, the error message "Selection array full" could be output several times rather than just once.

C. If a help file was not available and one entered the "HELP" command, the SASIO user interface would not respond to any subsequent commands.

D. If one entered an unrecognized command beginning with say the letter "I", the SASIO user interface would refuse to accept any subsequent commands beginning with the letters "A" to "H".

E. The program passed an undefined variable to the SASIO software, which resulted in a "segmentation fault" on a UNIX platform.

F. The VMS version of the portable disk I/O routines did not set the record attributes properly for DREA binary disk files.

G. The following terminal screen fields might not be completely cleared of old data when new values were displayed: output hydrophone numbers, output frames, channels to be greyscaled.

H. When a new input file was read, the program did not check to see if the previously specified output frame numbers were also valid for the new input file. This could result in the program trying to process non-existent input frames.

I. When the program processed complex input data, it modified the word in the input file's header which specified the x-axis units. Consequently if a "FRAMES" command was subsequently issued, the program would halt with a "division by zero" error.

J. If offsets were applied to the data plotted on-screen, the output SAPLOT files and automatically generated hardcopy files would have incorrect offsets.

K. Autoscaling of on-screen phase data was not done properly if one requested thresholding.

L. Thresholded phase data were not plotted properly on-screen if one asked for a log x-axis.

M. If the total number of curves to be plotted was not an integral multiple of the user-specified number of curves per plot, then no automatic hardcopy would be produced for the final plot. Another consequence was that the program would not pause after the final on- screen plot if one had requested an infinite display time.

N. One could not produce .GRY files with Murray's MAXION port of PLTPWR, since no statements were provided to write data to the .GRY file. This error was corrected by adding appropriate code to the new version of PLTPWR.

O. Output greyscale (.GRY) files would not be generated correctly if no normalization was requested. Output .GRY files might be incorrect depending on how many channels were processed.

P. PLTPWR's method of computing the 1/3 octave bands for an .OCT file was not the same as the method used by program PROPWR. Consequently, PLTPWR claimed some PROPWR .OCT files were inconsistent. This error was corrected by making PLTPWR's 1/3 octave computations agree with PROPWR's.

Q. If one specified an invalid number of spectra for the "AVERAGE AVERAGE" sub-command, the program would respond erratically to subsequent commands.

R. If one gave an incorrect file name for the "CALIBRATE SET" sub-command, the subsequent error message flashed by too quickly to be read.

S. Assume an error occurred when reading a calibration file. The file would still be shown in the list of calibration file names, even though the program wouldn't use the file.

T. If the "INITVAR" command was entered, the program did not close any open input or output files, even though it set flags indicating that these files had been closed. This error was corrected by closing the open files.

U. If one entered the command "INFIL @list.lst", the message "Error in opening input file" would appear in the UNIX version of PLTPWR. However, one could still successfully "POP" a file from the files list

V. The UNIX version of PLTPWR had an incorrect open statement for the output hardcopy file produced via the "PRINT" command. Consequently, the program halted with an error message when it attempted to execute that statement.

W. If one entered the command "INFIL *.PWR" and no .PWR files were found, the UNIX version of PLTPWR would halt.

X. If the user entered "EXIT" in response to the "PLOT>>" prompt, the program would switch to the "PSP>>" prompt at the end of the next plot, and the program would eventually crash.

Y. The user was not allowed to specify a window width for SAXA normalization.

Z. The "MEASURE" command gave incorrect values for cursor coordinates if either a log x-axis or a log y-axis was used.

2. DATA CHECKS

To prevent the user from entering invalid parameters which would cause the program to produce meaningless results, behave erratically or crash, the following data checks were added to PLTPWR:

A. Usage of the "FRAMES", "START_TIME" or "STOP_TIME" command is disallowed if no input file is open.

B. "GREY" commands are not permitted for complex input data since the program can only produce .GRY files from real input data.

C. The program checks the header data of the user-specified "HARDCOPY -> GFILE" and "HARDCOPY -> BFILE" files to ensure that they are .GRY and .BRG files respectively.

D. The "HMOD -> DATA -> MODIFY" sub-command is not permitted, since the program is not set up to modify data blocks.

E. Specifying an "NCURVES" value (number of curves per plot) of less than one is not permitted.

F. Normalization is not allowed if there are insufficient data points.

G. The wildcard character "*" is not allowed in the output file name ("OFILE" command).

H. Requesting a "START_TIME" or "STOP_TIME" which precedes the start of the input data file or is beyond its end is not allowed.

3. MISCELLANEOUS PROGRAM CHANGES

A. The UNIX version of PLTPWR formerly used a local DREA "lpr" command to spool print files to the DREA arrow computer. However, this local "lpr" command was not available on the camaro, unicorn and warrior computers. Moreover, the standard "lpr" command was not working since no printer queues had been set up for the SGI computers. Therefore the UNIX version of PLTPWR was changed to produce printouts by using the standard "lpspr" and "lp" commands.

B. The paper size is now selected via the VMS or UNIX system print command by specifying the sheet size rather than the input tray .

C. The default printer was changed from 251A or 251B to 362A, since the former printers were no longer available.

D. A "PRINT -> PRINTER" subcommand was added so that the user could

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specify the printer to be used for hardcopies of spectral plots.

E. Formerly the "MEASURE" command always printed y-coordinates with two digits after the decimal point. This was changed so that more digits were printed after the decimal point if the y-coordinate was less than 0.1.

F. The program was changed so that VMS or UNIX input data files could be processed under either operating system. Formerly the program could handle only native data files; processing of non-native data had not been fully implemented.

G. The software for converting data between VMS and UNIX formats was replaced by routines which handled exceptionally large and small numbers better.

H. The software was modified so that time calculations which produced a time after midnight caused the date to be rolled over to the next day. (Formerly the date remained unchanged.)

I. The format of greylevel information stored in the ASCII block of the .GRY file header was changed so that it was in the form expected by the Murray's new hardcopy function (Murray, 1997).

J. PLTPWR's on-line help file was updated.

K. The main menu prompt was changed from "PSP>>" to "PLT>>" to agree with the PLTPWR documentation (Farrell, 1992).

4. ADDITION OF X TERMINAL DISPLAY

To permit the display of plots on an X terminal, the program was changed to use the PGPLOT device-independent graphics package, rather than the STEK Tektronix graphics routines. The program now supports the following graphics terminals or terminal emulators: X terminal, VT240/330/340, VersaTerm-PRO (for Apple computers), and MS-DOS Kermit. NCSA MAC Telnet was not included, because cursor input did not work for it. Note that NCSA has not supported MAC Telnet since 1995.

Previously PLTPWR's graphics source code was in three files: lfload.f, stek_axp.f and stek_unix.f. lfload.f contained a routine for loading the STEK fonts. stek_axp.f (for AXP systems) and stek_unix.f (for UNIX systems) contained the other STEK graphics routines. In the new software, lfload.f is no longer used. stek_axp.f and stek_unix.f have been replaced with a single module, stek_pgplot.f.

5. PORT TO UNIX

Some of the work of porting the DEC VMS version of PLTPWR to SGI UNIX (IRIX) had already been done when the software was ported to the MAXION platform (Murray, 1997). Additional changes required were:

1. Correction of bugs and miscellaneous modifications as noted above.
2. Changes to accommodate differences between DEC and SGI FORTRAN (e.g., handling of carriage control, routines for returning the system date and time).

To accommodate differences between VMS and IRIX, PLTPWR uses some platform-specific source code files:

Table 3. *Platform –specific source code files.*

VMS	IRIX
make_axp.common	make_sgi.common
fdate_vms.f	N/A
magtape_vms.f	magtape_max.f
names_vms.f	names_max.f
pltpwr_vms_tab.f	pltpwr_sgi_tab.f
printer_vms.f	printer_sgi.f

make_axp.common or make_sgi.common is copied to machine.common, which defines some machine-specific variables. machine.common is included in PLTPWR's FORTRAN routines via a FORTRAN INCLUDE statement.

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III. PLTPWR USER'S MANUAL

The following write-up describes features specific to the modified version of PLTPWR, and supplements the original PLTPWR manual (Farrell, 1992).

1. RUNNING PLTPWR

Program PLTPWR is currently available at DREA on the VMS FIRM cluster, and on the SGI computers camaro, unicorn, and warrior.

To run PLTPWR on the FIRM cluster enter:

RUN_PS_72:[CHANG.PLTPWR.AXP]PLTPWR

To run PLTPWR on an SGI computer enter:

/usr/people/chang/PLTPWR/pltpwr

2. FILE FORMATS

A description of the calibration file as used by the "CALIBRATE -> SET" sub-command was not supplied in the original PLTPWR documentation (Farrell, 1992). The greyscale and bearing file formats had been changed since 1992 to accommodate the storage of greylevel and normalization information.

2.1 Calibration File Format

At the start of the ASCII calibration file are zero or more records containing SAPLOT directives (these are ignored by PLTPWR), followed by a record containing the word "CURVE". This is followed by pairs of frequency (Hz) and system response (dB) values, with one such pair per record. The data must be arranged in order of increasing frequency.

Within the frequency limits of the calibration file, straight line interpolation is used to obtain a calibration value for each frequency in the input spectrum file. If spectrum frequencies lie outside the frequency range of the calibration file, calibration values are extrapolated using the two highest or lowest frequency points (depending on the frequency being extrapolated) in the calibration file. Interpolation is usually preferable to extrapolation, so the frequency range of the calibration file should be maximized.

2.2 Greyscale (.GRY) File Format

There are currently two greylevel calculation methods, the standard method and the AGC method. Both methods are available in PRODAT, but only the standard method is used in PLTPWR. In the standard method, the same greylevel scaling is applied to all spectra.

In the AGC method, the greylevel scaling varies between spectra. After excluding a user-specified number of frequency bins at the start of the spectrum, the peak and mean values for each spectrum are determined. The dB values corresponding to the maximum and minimum greylevels are computed as follows:

maximum = peak - AMOUNT_DOWN * (peak - mean)
minimum = mean + AMOUNT_UP * (peak - mean)

where AMOUNT_DOWN and AMOUNT_UP are user-specified parameters.

Information regarding the greylevel parameters is stored in ASCII block, ALABEL, of the header record as follows [ALABEL(1) is the first byte of the ASCII block]:

ALABEL(100:105)
: The greylevel calculation method. Either "GL_STD" for the standard method, or "GL_AGC" for the AGC method. If the greylevel calculation method is unrecognizable, PLTPWR's hardcopy routine assumes the method is standard, with 8.0 dB for the maximum greylevel, 16 greylevels and an increment of 1.0 dB between greylevels.

ALABEL(106:129)
: The greylevel parameters, separated with spaces and terminated with a null byte. For the "GL_STD" method, the parameters are: the dB value (floating-point) corresponding to the maximum greylevel, the number of greylevels (integer), and the increment in dB (floating-point) between greylevels.

  For the "GL_AGC" method, the parameters are: the number of greylevels (integer), the number of points (integer) to ignore at the start of a spectrum when computing the spectrum's mean and peak, the "AMOUNT_DOWN" parameter (floating-point), and the "AMOUNT_UP" parameter (floating-point).

2.3 Bearing (.BRG) File Format

Information regarding the greylevel and normalization parameters is stored in ASCII block, ALABEL, of the header record as follows [ALABEL(1) is the first byte of the ASCII block]:

ALABEL(100:105)
: The greylevel calculation method. Either "GL_STD" for the standard method, or "GL_AGC" for the AGC method as per the greyscale (.GRY) file format (see section 2.2 above).

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ALABEL(106:129)

The greylevel parameters, separated with spaces and terminated with a null byte. These parameters are stored as per the greyscale (.GRY) file format.

ALABEL(130:138)

The normalization method. Either "NORM_NONE" for none, "NORM_SW2P" for split-window two-pass, or "NORM_OTA " for order-truncate-average. If
the normalization method is unrecognizable, PLTPWR's hardcopy routine assumes the method is NORM_SW2P with a window width of 20.

ALABEL(139:149)

The window width in bins (integer), followed by a null byte.

3. CHANGES TO PLTPWR COMMANDS

This section gives a brief description of PLTPWR commands which differ from those in the old version of PLTPWR (Farrell, 1992). The new "HARDCOPY" commands were introduced with the port of PLTPWR to the MAXION platform (Murray, 1997), but have not been previously documented.

3.1 Command Tables

Some of the HARDCOPY sub-commands have been replaced:

Table 4. Changes to the HARDCOPY command family.

OLD COMMAND	NEW COMMAND
HARDCOPY -> CMETHOD	HARDCOPY -> COMP_METHOD
HARDCOPY -> COMPRESSION	HARDCOPY -> COMP_FACTOR
HARDCOPY -> LABELS	HARDCOPY -> LAYOUT -> LABELS
HARDCOPY -> ORIENTATION	HARDCOPY -> PAPER

The following table summarizes the new and modified PLTPWR commands:

Table 5. *List of new and modified PLTPWR commands.*

COMMAND	SUB-COMMAND	SUB-SUB-COMMAND
GIN	CR NONE	
HARDCOPY	BFILE	
	COLOUR	GREEN MONO RAINBOW
	COMP_FACTOR	
	COMP_METHOD	AVERAGE MAXIMUM MEDIAN NONE
	LAYOUT	BALANCE COLS_MAX EXIT LABELS METHOD ROWS_MAX
	PAPER	LEDGER_LLANDSCAPE LEDGER_PORTRAIT LEGAL_LANDSCAPE LEGAL_PORTRAIT LETTER_LANDSCAPE LETTER_PORTRAIT
	PRINTER	
NORM	SAXA	
PRINT	PRINTER	
RUN	MEASURE	
TERM	KERMIT VERSA4014 VERSA4105 VT240 XTERM	
VISUAL		

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3.2 Command Descriptions

The above commands are described below in the following format:

Command: The name of the PLTPWR command or sub-command. For the case of a sub-command or a sub-sub-command, the command hierarchy is given in parentheses. For example, (TERM -> XTERM) for the XTERM sub-command of TERM.

Help string: The string which will appear on the user's terminal if a "?" is entered after the command.

Prompt: The prompt that will appear requesting further input required by the command.

Description: A description of the use of the command and its options.

Command: GIN

Help String: Select the Tektronix graphic input (GIN) terminator
Prompt: Tektronix GIN terminator:
Description: This command specifies the Tektronix graphic input (GIN) terminator used by the terminal or terminal emulator. This specification is ignored if one is using an X terminal or MS-DOS Kermit.

Sub-command: CR (GIN -> CR)
Help String: None
Prompt: None
Description: Specifies that a carriage return is used as the GIN terminator.

Sub-command: NONE (GIN -> NONE)
Help String: None
Prompt: None
Description: Specifies that there is no GIN terminator.

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Command: HARDCOPY

Help String: Select the desired hardcopying option
Prompt: PRINT>>
Description: This command provides an interface for producing greyscale printouts of the contents of greyscale (.GRY) or bearing (.BRG) files. The command can be used immediately after processing a .PWR file, or can be used to make hardcopies of previously processed files. A .GRY or .BRG file can be printed by starting PLTPWR and immediately entering the HARDCOPY command. A warning will appear which cautions the user that a .GRY or .BRG file must be selected via a GFILE or BFILE command.

Sub-command: BFILE (HARDCOPY -> BFILE)
Help String: Name for the bearing input file
Prompt: Bearing Input File:
Description: This allows the user to choose a .BRG file for printing.

Sub-command: COLOUR (HARDCOPY -> COLOUR)
Help String: Choose colour to use for printing lofargrams.
Prompt: Colour setting:
Description: This command lets the user set the colour(s) for the greyscale printouts.

Sub-sub-cmd: GREEN (HARDCOPY -> COLOUR -> GREEN)
Help String: None
Prompt: None
Description: The greyscale printouts will be in shades of green.

Sub-sub-cmd: MONO(HARDCOPY -> COLOUR -> MONO)
Help String: None
Prompt: None
Description: The greyscale printouts will be in shades of grey.

Sub-sub-cmd: RAINBOW (HARDCOPY -> COLOUR -> RAINBOW)
Help String: None
Prompt: None
Description: The greyscale printouts will be multi-coloured.

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Sub-command: COMP_FACTOR (HARDCOPY -> COMP_FACTOR)
Help String: Enter the data compression factor (for n, # pts out = # pts in/n)
Prompt: Data Compression Factor:
Description: This command lets the user specify how much compression should be applied to the greyscale data before it is stored in the hardcopy file. It is useful when the user wishes to see a larger frequency range on a single page. The method of compression can be selected with the HARDCOPY -> COMP_METHOD command.

Sub-command: COMP_METHOD (HARDCOPY -> COMP_METHOD)
Help String: Choose the data compression method.
Prompt: REDUCE>>
Description: This command lets the user specify the method to be used in compressing the data for the output hardcopy (if data compression is turned on). There are several choices available as sub-sub-commands.

Sub-sub-cmd: AVERAGE (HARDCOPY -> COMP_METHOD -> AVERAGE)
Help String: None
Prompt: None
Description: Compresses the display by calculating the average value of the data within the compression range and using it in the output hardcopy file. See HARDCOPY->COMP_METHOD->MINIMUM for an explanation of the compression range.

Sub-sub-cmd: MAXIMUM (HARDCOPY -> COMP_METHOD -> MAXIMUM)
Help String: None
Prompt: None
Description: Compresses the display by calculating the maximum data point within the compression range and using it in the output hardcopy file.

See HARDCOPY->COMP_METHOD->MINIMUM for an explanation of the compression range.

Sub-sub-cmd: MEDIAN (HARDCOPY -> COMP_METHOD -> MEDIAN)
Help String: None
Prompt: None
Description: Compresses the display by calculating the median value of the data within the compression range and using it in the output hardcopy file. See HARDCOPY->COMP_METHOD->MINIMUM for an explanation of the compression range.

Sub-sub-cmd: MINIMUM (HARDCOPY -> COMP_METHOD -> MINIMUM)

Help String: None
Prompt: None
Description: Compresses the display by calculating the minimum data point within the compression range and using it in the output hardcopy file. If, for example, the compression factor is set to 4, the minimum of the first 4 data points is chosen as the first hardcopy point, the minimum of the next 4 data points is chosen as the
second hardcopy point, etc.

Sub-sub-cmd: NONE (HARDCOPY -> COMP_METHOD -> NONE)
Help String: None
Prompt: None
Description: Effectively turns data compression off.

Sub-command: LAYOUT (HARDCOPY -> LAYOUT)
Help String: Choose a page layout option:
Prompt: LAYOUT>>
Description: This command lets the user specify how the greyscale plots will be arranged on each page and whether the plots will be labelled. The command has its own status screen.

Sub-sub-cmd: BALANCE (HARDCOPY -> LAYOUT -> BALANCE)
Help String: Turn data division balancing on/off.
Prompt: Balance On/Off:
Description: Lets the user turn data division balancing on/off. Balancing involves trying to make all the greyscale plots of equal size. If the plots are arranged by time, they will have equal x-axis (frequency) lengths. If the plots are arranged by frequency, they will have equal y-axis (time) lengths.

Sub-sub-cmd: COLS_MAX (HARDCOPY -> LAYOUT -> COLS_MAX)
Help String: Set the maximum number of plots to fit across a page.
Prompt: Maximum columns:
Description: Lets the user specify the maximum number of columns of plots per page.

Sub-sub-cmd: EXIT (HARDCOPY -> LAYOUT -> EXIT)
Help String: None
Prompt: None
Description: This command exits from LAYOUT>> back to the PRINT>> prompt.

Sub-sub-cmd: LABELS (HARDCOPY -> LAYOUT -> LABELS)
Help String: Turn frequency and time axis labels on/off.
Prompt: Labels On/Off:
Description: This command allows the user to turn frequency and time labels on or off in the output hardcopy file. It is sometimes necessary for classification reasons to turn the labels off.

Sub-sub-cmd: METHOD (HARDCOPY -> LAYOUT -> METHOD)
Help String: Choose a plot arrangement method.
Prompt: Method:
Description: This command allows the user to specify the order in which the plots will be arranged. Each greyscale plot contains data for a single channel, with a range of frequencies on the x-axis, and a range of times on the y-axis. Plotting is done in the program via three nested loops, with a new page started at the beginning of each outermost loop, and a plot produced in the innermost loop. Each loop index is for either a channel number, a frequency range, or a time range. For example, the "NORMAL" plot arrangement order is channel, time and frequency, with the channel number index being the outermost loop, and frequency range index the innermost loop. The possible plot arrangement methods are:

FREQ_ASSOC - The arrangement hierarchy is time, frequency, and channel. In other words, identical frequency ranges are plotted together.
FREQ_SNAKE - The arrangement hierarchy is channel, time and frequency.
NORMAL - Same as FREQ_SNAKE.
TIME_ASSOC - The arrangement hierarchy is frequency, time and channel. That is, identical time ranges are plotted together.
TIME_SNAKE - The arrangement hierarchy is channel, frequency and time.

Sub-sub-cmd: ROWS_MAX (HARDCOPY -> LAYOUT -> ROWS_MAX)
Help String: Set the maximum number of plots to fit down a page.
Prompt: Maximum rows:
Description: Lets the user specify the maximum number of rows of plots per page.

Sub-command: PAPER (HARDCOPY -> PAPER)
Help String: Select the paper type and orientation for hardcopy output.
Prompt: Paper size/orientation:
Description: Lets the user specify the orientation and paper size for hardcopy greyscales.

Sub-sub-cmd: LEDGER_LANDSCAPE (HARDCOPY -> PAPER -> LEDGER_LANDSCAPE)
Help String: None
Prompt: None
Description: Specifies landscape mode printing on ledger size paper.

Sub-sub-cmd: LEDGER_PORTRAIT **(HARDCOPY -> PAPER -> LEDGER_PORTRAIT)**

Help String: None
Prompt: None
Description: Specifies portrait mode printing on ledger size paper.

Sub-sub-cmd: LEGAL_LANDSCAPE **(HARDCOPY -> PAPER -> LEGAL_LANDSCAPE)**

Help String: None
Prompt: None
Description: Specifies landscape mode printing on legal size paper.

Sub-sub-cmd: LEGAL_PORTRAIT **(HARDCOPY -> PAPER -> LEGAL_PORTRAIT)**

Help String: None
Prompt: None
Description: Specifies portrait mode printing on legal size paper.

Sub-sub-cmd: LETTER_LANDSCAPE **(HARDCOPY -> PAPER -> LETTER_LANDSCAPE)**

Help String: None
Prompt: None
Description: Specifies landscape mode printing on letter size paper.

Sub-sub-cmd: LETTER_PORTRAIT **(HARDCOPY -> PAPER -> LETTER_PORTRAIT)**

Help String: None
Prompt: None
Description: Specifies portrait mode printing on letter size paper.

Sub-command: PRINTER (HARDCOPY -> PRINTER)

Help String: Choose printer: LPS_362A, LPS_362B, LPS_362C, etc. (VMS)
Choose printer: rm362a, rm362b, rm362c, etc. (IRIX)
Prompt: Choose printer for output:
Description: Lets the user specify the printer for hardcopies of greyscale plots.

Command: NORM

Sub-command: SAXA **(NORM -> SAXA)**

Help String: Enter the width of the normalizer window in bins.
Prompt: Window Width:
Description: This sub-command turns on the SAXA normalizer. The SAXA (Split-Average-eXclude-Average) normalizer performs well.

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After this sub-command is used, control returns to the main menu and the PLT>> prompt reappears.

Command: PRINT

Help String: Select the desired power spectrum print option.
Prompt: Hardcopy option:
Description: This command lets the user set the spectrum hardcopy printing intervals and direct the hardcopy output either to the printer or to a PostScript file.

Sub-command: PRINTER (PRINT -> PRINTER)

Help String: Choose printer: LPS_362A, LPS_362B, LPS_362C, etc. (VMS)
Choose printer: rm362a, rm362b, rm362c, etc. (IRIX)
Prompt: Choose printer for output:
Description: Lets the user specify the printer for hardcopies of spectra.

Command: RUN

Help String: None
Prompt: None
Description: This command causes PLTPWR to calculate greyscales or display the data in the input file according to the parameters the user has set. When the program has completed a display and is in pause mode (infinite display time), a PLOT>> prompt appears and any of the RUN sub-commands may be entered.

Sub-command: MEASURE (RUN -> MEASURE)

Help String: None
Prompt: None
Description: Activates a cursor on the terminal screen. The current cursor X and Y values are written to the screen when any key (other then "e", "E", "x" or "X") is hit or the left mouse button is pressed. It is useful for determining the frequencies and levels of lines within displayed spectra. Control returns to the PLOT>> prompt when an "e", "E", "x" or "X" is entered or the right mouse button (X terminal only) is pressed. At that point, any of the RUN sub-commands can be entered. Note: When using the Kermit terminal emulator under IRIX, pressing the left or right mouse button will cause the cursor coordinates to be written to the screen. However, some extraneous characters will also appear at the left of the plot.

Command: TERM

Help String: Select your terminal type
Prompt: Terminal type:
Description: This command specifies the type of graphics terminal being used. If one is using neither an X terminal nor a Tektronix compatible one, the TERM setting does not matter, but one should enter the "VISUAL OFF" command.

Sub-command: KERMIT (TERM -> KERMIT)

Help String: None
Prompt: None
Description: Specifies that the MS-DOS Kermit terminal emulator is being used.

Sub-command: VERSA4014 (TERM -> VERSA4014)

Help String: None
Prompt: None
Description: Specifies that VersaTerm-PRO Tektronix 4014 terminal emulation is being used on an Apple computer.

Sub-command: VERSA4105 (TERM -> VERSA4105)

Help String: None
Prompt: None
Description: Specifies that VersaTerm-PRO Tektronix 4105 terminal emulation is being used on an Apple computer.

Sub-command: VT240 (TERM -> VT240)

Help String: None
Prompt: None
Description: Specifies that a DEC VT240/330/340 terminal or emulator is being used.

Sub-command: XTERM (TERM -> XTERM)

Help String: None
Prompt: None
Description: Specifies that an X terminal is being used.

Command: VISUAL

Help String: Turn on-screen plotting ON/OFF (Should be off for non-graphics terminals)
Prompt: Turn on-screen plotting ON/OFF:
Description: This command causes lets the user disable on-screen plotting of the selected frames and channels. It is useful when the user wants a hardcopy of spectra in a .PWR, .CRS, .COH, .BRG or .OCT file, but does not have access to a graphics terminal.

By entering the commands "VISUAL OFF" and "PRINT INTERVAL 1" in addition to selecting the desired frames and channels, the user can obtain the desired hardcopies.

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4. COMPILING AND LINKING PLTPWR

4.1 VMS

PLTPWR uses a modified version of the SASIO user-interface library which is located in directory PS_72:[CHANG.SASIO] on the DREA FIRM cluster. The SASIO library is created by entering the following command while in the [CHANG.SASIO] directory:

```
@MAKE_AXP
```

Program GENCOM which generates a FORTRAN SASIO command table subroutine is compiled and linked by entering this command from within the [CHANG.SASIO] directory:

```
@MAKE_GENCOM
```

Program PLTPWR requires the creation of the SASIO command table subroutine PLTPWR_VMS_TAB.F. This can be done by entering the following commands while in the PS_72:[CHANG.PLTPWR] directory:

```
RUN [CHANG.SASIO]GENCOM
INFIL PLTPWR_VMS.TAB
TERM OFF
OFIL PLTPWR_VMS_TAB.F
RUN
QUIT
```

PLTPWR can be compiled and linked by entering the following DCL commands from within the PS_72:[CHANG.PLTPWR] directory:

```
@[CHANG.PGPLOT.AXP]DREA_LOGICAL
@MAKE_AXP
```

4.2 IRIX

PLTPWR uses a modified version of the SASIO user-interface library which is located in directory /usr/people/chang/SASIO on the DREA SGI computers. The SASIO library is created by entering this command while in the chang/SASIO directory:

```
make sgi
```

Program GENCOM which generates a FORTRAN SASIO command table subroutine is compiled and linked by entering this command from within the chang/SASIO directory:

```
make -f makefile_gencom_sgi gencom
```

Program PLTPWR requires the creation of the SASIO command table subroutine pltpwr_sgi_tab.f. This can be done by entering the following commands while in the /usr/people/chang/PLTPWR directory:

```
../SASIO/gencom
INFIL pltpwr_sgi.tab
TERM OFF
OFIL pltpwr_sgi_tab.f
RUN
QUIT
```

PLTPWR can be compiled and linked by entering the following commands from within the chang/PLTPWR directory:

sh shell:

```
PGPLOT_DIR="/usr/people/chang/PGPLOT/pgplot/"; export PGPLOT_DIR
make sgi
```

csh or tcsh shell:

```
setenv PGPLOT_DIR /usr/people/chang/PGPLOT/pgplot/
make sgi
```

IV. DISP AND DISPX MODIFICATIONS

Programs DISP and DISPX take any DREA standard .DAT multi-channel time series data file and selectively display the contents. These programs can also selectively output the time series data to another .DAT file, a sound file for a Macintosh, a SAPLOT file, or a set of MAGIC files. The following write-up includes information that was previously available in various text files on disk.

The main differences between DISP and DISPX are:

1. DISP uses the STEK plotting library, whereas DISPX uses the PGPLOT library. Consequently DISP can display data only on Tektronix 40XX compatible terminals, with hardcopy output to Tektronix format files. However DISPX can plot on either Tektronix 40XX/41XX compatible terminals or on X terminals, with hardcopy output to Tektronix or PostScript files.
2. DISP is available on VAX and AXP machines, whereas DISPX is available only on AXP machines.

The changes made to DISP and DISPX included:

1. The ability to plot data in decibel (dB) format was added.
2. Handling of input data with "square" or "log" y-axis units was improved.
3. The usage of IMSL subroutines was dropped.
4. A bug was corrected whereby the gain correction factor specified in the .DAT file header block wasn't being properly used.

1. RUNNING DISP OR DISPX

1.1 Logical Name

The DISP/DISPX subroutine for performing cross correlations (invoked by the program's "X" command) assumes that the logical name "SAPS" is the command for executing the DREA plotting program SAPLOT. SAPS can be defined by the following DCL command:

```
SAPS=="$SOFTPACS:[VEST.SAPLOT_PS]SAPLOT_PS.EXE" (AXP)
        or
SAPS=="$DREAPACS:[EXE]SAPLOT_PS.EXE" (VAX)
```

One may wish to include the above command in their LOGIN.COM file.

1.2 Starting DISP or DISPX

Programs DISP and DISPX are currently available at DREA on the VMS FIRM cluster.

To run DISPX on an AXP machine enter:

RUN_PS_72:[CHANG.DISP.AXP]DISPX

To run DISP on an AXP machine enter:

RUN_PS_72:[CHANG.DISP.AXP]DISP

To run DISP on a VAX machine enter:

RUN_PS_72:[CHANG.DISP.VAX]DISP

1.3 Initial User Input

Some of the following input prompts do not appear in both DISP and DISPX:

- When asked "Terminal type (1=X, ...)", indicate the type of graphics terminal being used.
- When asked "Use hardware font for Tektronix terminal (0=no, 1=yes)", enter "0" to use the PGPLOT software font or else "1" to use the terminal's font. One should not request the hardware font if one is using a Tektronix 4100 terminal.
- When asked "Type of GIN terminator", specify the Tektronix graphics input terminator.
- When asked "Hardcopy file type", indicate the desired hardcopy file format.
- When asked "Delay after screen erase (seconds)", type "<return>" if one is using a Tektronix terminal emulator. For a true Tektronix terminal, type "2" or so.
- When asked "Is file on tape (MKDxxx) or disk (D)", type "<return>" if the file is on disk. If the file is on tape, enter the name of the tape drive (e.g., "MKD600:").
- When asked "Input file name", type the name of the .DAT file to be displayed. If this is a disk file, it can contain a node, device or directory name. If the file is on tape, the file name must match exactly the characters in the tape label (e.g. "S01234.DAT") unless there is a "*" in the name. In that case, the characters up to but not including the "*" must match the corresponding characters in the tape label. The magnetic tape will be rewound before its first file search. On all subsequent new file requests while the program is running, it will start looking in the forward direction until the tape

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reaches the end of data. If the file is not found, the tape will be rewound and the tape will be searched from its beginning.

- When asked "Display how many channels", the maximum number displayable is shown as the default. DISP/DISPX will display a maximum of 16 of the channels in the .DAT file for real data, or up to 8 channels for complex data. It is suggested that one type "1" at first, so that the search of the whole file will proceed quickly.

- When asked "Channel #", type the number of the channel which one wishes to appear next going down the display screen. The legitimate channel numbers are listed for one's convenience. If one types a negative number, all the channel numbers up to the corresponding positive channel number are added to the list.

- When asked "Use header gains", type "<return>" to display the data as they appear at the digitizer input. This is normally best, since the data are usually of comparable magnitude from channel to channel at this point. If one wishes the header gains included, type "Y".

1.4 Interactive Commands

One will now be faced with a window of displayed data, and a question mark in a dialog region. Depending on terminal or terminal emulator being used, the dialog region may be at the bottom of the graphics window, or else in a separate text window. The program does not automatically change input focus between the graphics window and the text window; this must be done manually by the user.

In response to the "?" prompt, one can enter one of the following commands:

? Type this to get some on-line help.

<return>
Erase and then update the graphic display. Note that several changes to the display parameters can be made before updating the display.

*<number>
Set y scaling value. All channels are multiplied in the y-axis by this scaling value. dB mode (see "Y" command) and non-dB mode can have different y scaling values.

@<number> **(new)**
Set number of voltage**2 values to be averaged when plotting dB data. Default is 1. This number must be less than the display resolution (see "R" command below).

^<number> **(new)**
Set the y-axis maximum in decibels for dB plots. Default is to have

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the maximum automatically chosen (i.e., if one enters only "^").

A Auto gain. This commands the program to check the displayed portion of each channel for maximum and minimum levels, then to set the extra gain for that channel to bring it to full scale (offsets are not changed, so it will normally be full scale positive or negative but not both).

B Band pass filter displayed time series window. The filter is a zero order Kaiser-Bessel (beta=6.76 to give a typical -70 dB stop band and 0.00275dB pass band ripple) using an overlap and save algorithm. The window size must be a multiple of 1024 points (chosen to facilitate implementation of the filter); use the "W" command to do this. Presently only filtering of real time series is implemented, and up to 16 channels can be filtered. One can abort filtering by typing <control-C>. The introduced delay of the overlap and save algorithm (512 points for this filter) is filled with zeroes to maintain the same window size as the original display.

C Cursor on. If one adjusts the cursor and then types a character, the x and y values of the cursor position will be typed in the dialog location, and the cursor location will be marked by the character. The character "=" is special, however; see below.

X terminal cursor usage in DISPX differs from Tektronix cursor usage:

1. Entering the "C" command on an X terminal puts the program in cursor mode. The graphics cross-hair cursor remains present until one presses mouse button 3 or else types an "X" at the keyboard.

2. One has the choice of marking points via the keyboard or by using the mouse buttons. (The latter method is simpler.) To enter characters via the keyboard, one must first assign input focus to the graphics window. This can be done by clicking on the title bar of the graphics window.

3. Mouse buttons 1 to 3 are mapped by PGPLOT to the letters "A", "D" and "X". DISPX further maps the letter "D" to the character "=". Pressing mouse button 1 or the "A" key labels the point with an unused upper case letter.

    - Pressing mouse button 2, the "D" key or the "=" key is the same as pressing "=" on a Tektronix terminal.
    - Pressing mouse button 3 or the "X" key exits cursor mode and returns one to keyboard command mode. One must manually return input focus to the text window.

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- Pressing a key other than "A", "D", "X" or "=" causes the point to be labelled with that character.

D DC offset removal. This commands the program to median filter the displayed portion of each channel then set the offset to remove the median.

E Extras - used to set extra parameters:

P When asked "Hardcopy command", type "<return>" for the default printer. For another device, type the command which will take a the Tektronix or PostScript file and hardcopy it. (The word "file" in this command will be replaced by the name of the file to be printed.) This command will be spawned to the monitor followed by the name of the file containing the plot data, whenever the user types the "P" command in the rest of the program.

F File to plot - choose a new file to display. The same time limits as on the current display will be initially applied to the new file. Note that for magnetic tape input, the file must be further on in the tape. If not, then one must rerun the program to rewind the tape.

G Gain adjustments and using header gains. The header gains mentioned previously can be used or ignored. As well, an extra gain can be applied for each of the channels in the .DAT file. Extra gains are applied after offsets (see "O" command) are added.

H Hear it on the Macintosh. "SoundEdit" software on the Macintosh will interactively replay time series data using the computer's built-in speaker. The output binary file must be transferred to the Macintosh, and the file type and creator manually changed to "FSSD" and "FSSC" respectively.

I Infill upper(U), lower(L), both(B) or none(N). Each data point on all channels can be marked with a vertical line to zero. This has the effect of shading the areas under and/or over the data curve, which can be useful for eye integration in some cases. Infilling is not done for dB or log plots.

J Jump to the system (DCL) temporarily. This allows the user to do directory lists, etc. without stopping DISP/DISPX or losing data.

L Save hardcopy of plot in a file, but do not print it. This command is present only in program DISPX. (Program DISP automatically produces hardcopy plot files.) See the description of the "P" command for the naming convention for these files. Also see the next section regarding DISPX hardcopies.

M MAGIC file output of the window data. This causes three files to be created: MAGIC.FRM, MAGIC.VAR, and MAGIC.MAC. The file name "MAGIC" can be changed if desired. The complete data between the time limits of the display are sent to the .FRM file. All the original channels or only those displayed may be output. In order to use MAGIC on the resulting files, just exit the program and run MAGIC. Note that one may need to change to a large directory since MAGIC takes a lot of room.

N Numbers of channels to be displayed can be changed with this command. The number of channels to plot is requested. If fewer than all the channels in the .DAT file are requested, then the user is asked for channel numbers. If one types a negative number, all the channel numbers up to the corresponding positive channel number are added to the list.

O Offsets channels in y direction. A separate offset for each channel may be applied with this command.

P Print hardcopy of this plot. This currently does the hardcopy to the default printer, but can very easily be changed (see "E" command). Every time a plot is printed, the Tektronix or PostScript output is saved in a new file so one can save this hardcopy file. These files are named as follows:

- DISP Tektronix files: "DISP.LSR001", "DISP.LSR002", ...
- DISPX Tektronix files: "DISPX.LSR001", "DISPX.LSR002", ...
- DISPX PostScript files: "DISPX.PSL001", "DISPX.PSL002", ...

The files are overwritten the next time one runs the program. See the next section regarding DISPX hardcopies.

Q Quit the program.

R Resolution of the display. This has several effects. By default, this is 500. If there are fewer than or equal to this number of data points per channel, then they are plotted directly. If there are greater than this number of data points, then the resolution is divided into half this number of cells, each containing the minimum and maximum for its portion of the data. Some video screens only have a resolution of 500 or so points across. A laser printer has a resolution as good as or better than the maximum allowable (8000 data points per channel). When one is about to do a hardcopy to the laser printer, if the number of data points to be displayed is greater than the currently set resolution, then set the resolution to 8000 temporarily. The only problem with leaving the resolution at a high number is that refreshing the display takes longer. Note that in program DISP, above 1024 point resolution the Tektronix 4014 extra byte output is used which slows output further.

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S SAPLOT file output of window data. This output file is used for producing high quality plots. It may be edited with a text editors. To plot it, quit DISP (or use command "J") and then enter the DCL command to run SAPLOT.

T Transfer window to .DAT file. The complete data between the time limits of the display are sent to another .DAT file. All the original channels or only those displayed may be output. This is useful for selecting data for further analysis.

W Window size to fit fixed blocks. The maximum of the time axis may be set according a multiple of an integer number of data points.

X This function's purpose is to do cross correlations of each channel with a user-chosen channel and then write times for the peak of the correlation series to SAPLOT files. It is assumed that the DCL command "SAP" will run program SAPLOT.

Y (new)
dB mode; the Y-axis will be in units of decibels. This command toggles dB mode on/off. dB mode applies to on-screen plots, hardcopies and output to SAPLOT files (see "S" command).

Z Zap mode; this command toggles the mode on/off. This mode does not affect program operation for a selection of data points that fit within the screen resolution. However, for large numbers of data points, this mode tells the data presentation algorithm to read only a single data point for each screen resolution cell instead of reading all data points and taking the minimum and maximum for each screen resolution cell. The advantage is speed; the disadvantage is possible missed transients.

1.5 DISPX Hardcopies

1. DISPX Tektronix format files are always in Tektronix 4014 format. DISP files can be in either Tek 4010 or Tek 4014 format, depending on the user-specified plot resolution.

2. DISPX can output graphics to only one device at a time. As a result, hardcopy plot files are not automatically produced. Instead, they are produced only when one enters the "P" or "L" command.

3. A "P" or "L" command generates a file based on the current plot settings. Thus if one changes the x-axis or y-axis limits without updating the screen plot, the hardcopy plot will not match the screen plot, and any cursor locations will not appear on the hardcopy.

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4. The area at the bottom of the hardcopy plot contains only the x and y values for the cursor locations marked via the "C" command. Locations marked by an "=" are not recorded on the hardcopy.

1.6 Setting Time Axis Limits

The following commands can change the x-axis limits:

,	No change to this time
=<number>	Set this time
+<number>	Add to this time
-<number>	Subtract from this time
_<number>	Set time span from other limit
<	Shift window left
>	Shift window right

These commands always occur in pairs. The first command applies to the x-axis minimum and the second command applies to the x-axis maximum. (To remind one of this, if the dialog region is beneath the graph, the prompt moves right one quarter screen width for the second command.) If the command is "," then the value is unchanged. If the command is "=5.123" for example, the value is set to 5.123 seconds. If the command is "+0.2" for example, then the value is increased by 0.2 seconds. If the command is "-12" for example, then the value is decreased by 12 seconds. If the command is "_2.5" for example, then the value is set to 2.5 seconds from the other limit. If the command is "<", then the whole window is shifted one half window width to the left (smaller times). If the command is ">", then the whole window is shifted one half window width to the right (larger times).

The cursor can also be used to set these values. Type "C<return>" at the prompt to turn on the cursor. Position it, then type "=". The value will be set.

1.7 User Routines

These are invoked by the following command:

0 to 9	Call USER0 to USER9 user written routines.

To link your own routines to DISP or DISPX, you should:

1. Copy USERSB.FOR from PS_72:[CHANG.DISP] to your own directory.

2. Modify your version of USERSB.FOR as desired.

3. Create subdirectory [.VAX] (VAX machine) or [.AXP] (AXP machine) which will hold your own version of DISP.EXE or DISPX.EXE. (Currently DISPX can be created only on an AXP machine.)

4. Define the logical name DC_DCL (used by DISPMAKE.COM) via DEFINE DC_DCL PS_72:[CHANG]

5. If you're going to create DISPX, you must define some variables via @PS_72:[CHANG.PGPLOT.AXP]DREA_LOGICAL

6. Create your version of DISP.EXE or DISPX.EXE via:

@PS_72:[CHANG.DISP]DISPMAKE DISP USER_DIR

or

@PS_72:[CHANG.DISP]DISPMAKE DISPX USER_DIR

where USER_DIR is your directory which contains USERSB.FOR.

For example:

@PS_72:[CHANG.DISP]DISPMAKE DISPX PS_102:[SMITH.MYSONAR]

1.8 Aborting Commands

Typing the character "-" in response to questions after the commands "?", "B", "F", "H", "M", "S", or "T" will abort these commands.

Typing the character "<control-C>" will abort a plot while it is being calculated or plotted.

2. COMPILING AND LINKING DISP OR DISPX

DISP can be compiled and linked by entering the following DCL command from within the PS_72:[CHANG.DISP] directory:

@DISPMAKE DISP

DISPX can be compiled and linked by entering the following DCL commands from within the PS_72:[CHANG.DISP] directory:

@[CHANG.PGPLOT.AXP]DREA_LOGICAL
@DISPMAKE DISPX

V. PROPWR MODIFICATIONS

PROPWR is a program for processing power spectrum files (Farrell, 1993). The additions made to this program included:

1. The ability to display plots on an X terminal.
2. The capability to track lines whose frequency position varies with time.
3. Alternative methods of estimating background noise.

1. ADDITION OF X TERMINAL DISPLAY

To permit the display of plots on an X terminal, the program was changed to use the PGPLOT device-independent graphics package, rather than the STEK Tektronix graphics routines. The program now supports the following graphics terminals or terminal emulators: X terminal, VT240/330/340, VersaTerm-PRO (for Apple computers), and MS-DOS Kermit.

2. LINE CALIBRATION

To allow the program to track lines whose frequency varies over time, line position information can be supplied to PROPWR in the form of ASCII files. The following sample file contains information about three tracking bands:

```
3
10:20:00 200.0 300.0 400.0
10:22:10 180.0 310.0 400.0
10:25:00 170.0 320.0 420.0
... ... ... ...
10:44:00 180.0 320.0 440.0
```

The first record of the file specifies the number (N) of tracking bands referenced in the file, where N <= 20. (N must be greater than or equal to the number of tracking bands specified via PROPWR's "TRACK" command.) The subsequent records (at most 50) contain:

1. The absolute time in hours, minutes, and seconds in the format HH:MM:SS. The seconds field can have an optional fractional part (e.g., HH:MM:SS.SSS). Times must appear in increasing order within the file.
2. The centre frequencies (Hz) for the N line tracking bands at this time. The frequencies in a record need not be in ascending order.

The frequencies contained in the first record apply to times less than or equal to the specified time. Similarly, the frequencies in the final record are for times greater than or equal to the given time. The program determines the frequencies for intermediate times by linear interpolation between the two nearest times.

The bandwidths of the tracking bands and their associated noise estimation bands, as well as their relative frequency positions, are assumed to be time invariant. These bandwidths are specified via the program's "TRACK" command. N.B.: The program associates each line tracking band with the closest band centre frequency in the first record of the calibration file.

Previously in PROPWR, the background noise level was estimated at the peak location by linear interpolation between the median noise estimates in two adjacent noise bands. Additional methods of estimating the background noise level at the peak location are now available. These methods use various normalization techniques (Struzinski, 1984; Cox, 1996). Some of these techniques were already used in the program for the undocumented trend removal option.

3. MISCELLANEOUS PROGRAM CHANGES

A. During 1/3 octave band processing, the powers for bins within a band were being averaged in the logarithmic (dB) domain. This has been changed so that the powers are averaged in the linear domain, in agreement with what is stated on page 23 of the PROPWR manual (Farrell, 1993).

B. DREA binary 1/3 octave output files can now be produced.

C. The "OTYPE" command for setting the storage type for 1/3 octave output data now works properly.

D. Entering "q" or "Q" now aborts the "TRACK -> GSET" command as stated on page 36 of the PROPWR manual.

E. PROPWR uses the version of SASIO that was corrected for use with the revised PLTPWR program (previously described in this report).

F. PROPWR's on-line help file was updated.

G. The main menu prompt was changed from "OCT>>" to "PWR>>" to agree with the existing PROPWR documentation.

H. In the main status screen, the type of noise estimation being used was added in parentheses to the "Line Tracking" field.

VI. PROPWR USER'S MANUAL

The following write-up describes features specific to the modified version of PROPWR, and supplements the original PROPWR manual (Farrell, 1993).

1. RUNNING PROPWR

Program PROPWR is currently available at DREA on the VMS FIRM cluster.

To run PROPWR on the FIRM cluster enter:

RUN_PS_72:[CHANG.PROPWR.AXP]PROPWR

2. TREND REMOVAL FILE FORMAT

The output file containing trend removal information was not documented in the PROPWR manual (Farrell, 1993). This ASCII SAPLOT file has the following format, where:

n is the number of channels being processed.
m is the number of frames being processed.
k is the number of frequency bins in a spectrum.

(Spectrum values are in either volts**2 or dB as set by the "TRDTYPE" command.)

SAPLOT	preamble
CURVE	! Original spectrum for channel 1, frame 1
	1st frequency 1st spectrum value
	... ...
	kth frequency kth spectrum value
CURVE	! Normalized (detrended) spectrum for channel 1, frame 1
	1st frequency 1st normalized spectrum value
	... ...
	kth frequency kth normalized spectrum value
CURVE	! Noise estimates (trend) for channel 1, frame 1
	1st frequency 1st noise estimate
	... ...
	kth frequency kth noise estimate
CURVE	! Original spectrum for channel 1, frame 2
	...
CURVE	! Normalized spectrum for channel 1, frame 2
	...
CURVE	! Noise estimates for channel 1, frame 2
	...

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```
                ...
CURVE           ! Original spectrum for channel 1, frame m
                ...
CURVE           ! Normalized spectrum for channel 1, frame m
                ...
CURVE           ! Noise estimates for channel 1, frame m
                ...
CURVE           ! Original spectrum for channel 2, frame 1
                ...
CURVE           ! Normalized spectrum for channel 2, frame 1
                ...
CURVE           ! Noise estimates for channel 2, frame 1
                ...
                ...
CURVE           ! Original spectrum for channel n, frame m
                ...
CURVE           ! Normalized spectrum for channel n, frame m
                ...
CURVE           ! Noise estimates for channel n, frame m
                ...
```

3. CHANGES TO PROPWR COMMANDS

This section gives a brief description of PROPWR commands which differ from those given in the PROPWR manual (Farrell, 1993).

3.1 Command Table

The following table summarizes the new, modified, or previously undocumented PROPWR commands:

Table 6. *List of new or modified commands for PROPWR.*

COMMAND	SUB-COMMAND	SUB-SUB-COMMAND
BFILE		
GIN	CR NONE	
LINE_CAL	EXIT OFF ON RESET SET	
NORM	HARMONIC NONE OTA SAXA SPLIT_WINDOW TWO_PASS	
PRUN	MEASURE	
TERM	KERMIT VERSA4014 VERSA4105 VT240 XTERM	
TRACK	GSET	
	NOISE	NORM TWO_BAND
TRDFILE		
TRDTYPE	DB LINEAR	
TREND		

3.2 Command Descriptions

The above commands are described below in the following format:

Command: The name of the PROPWR command or sub-command. For the case of a sub-command or a sub-sub-command, the command hierarchy is given in parentheses. For example, (TERM -> XTERM) for the XTERM sub-command of TERM.

Help string: The string which will appear on the user's terminal if a "?" is entered after the command.

Prompt: The prompt that will appear requesting further input required by the command.

Description: A description of the use of the command and its options.

Command: BFILE

Help String: Enter an octave band file name. (SAPLOT format.)
Prompt: 1/3 Octave Filename:
Description: This command lets the user change the name of the 1/3 octave output ASCII SAPLOT format file. The output file name defaults to the input file name with an .octsap extension. A DREA binary format 1/3 octave file with a the same name, but with an .oct extension, will also be created.

Command: GIN

Help String: Select the Tektronix graphic input (GIN) terminator
Prompt: Tektronix GIN terminator:
Description: This command specifies the Tektronix graphic input (GIN) terminator used by the terminal or terminal emulator. This specification is ignored if one is using an X terminal or MS-DOS Kermit.

Sub-command: CR (GIN -> CR)
Help String: None
Prompt: None
Description: Specifies that a carriage return is used as the GIN terminator.

Sub-command: NONE (GIN -> NONE)
Help String: None
Prompt: None
Description: Specifies that there is no GIN terminator.

Command: LINE_CAL

Help String: Select the desired calibration option:
Prompt: LINE_CAL>>
Description: The LINE_CAL command has several sub-commands which aid in setting up line tracking calibration. The command lets the user specify how the line tracking frequency bands (defined by the TRACK command) vary in position over time. Line calibration can be turned on or off, the calibration arrays can be cleared in order to read in new calibration data, and the calibration data can be read from files into the calibration arrays. Up to 8 different sets of data can be used to calibrate the line tracking bands. (Note: Line calibration is OFF by default, so even after the user has read in calibration data, line calibration must still be turned ON in order for the tracking bands to be calibrated. The main menu indicates whether line calibration is OFF or ON.)

Sub-command: EXIT (LINE_CAL -> EXIT)
Help String: None
Prompt: None
Description: This sub-command leaves the LINE_CAL sub-menu and returns the user to the PWR>> prompt and the main status screen.

Sub-command: OFF (LINE_CAL -> OFF)
Help String: None
Prompt: None
Description: The OFF sub-command turns line calibration off without further user action and returns to the LINE_CAL>> prompt.

Sub-command: OFF (LINE_CAL -> ON)
Help String: None
Prompt: None
Description: The ON sub-command turns line calibration on without further user action and returns to the LINE_CAL>> prompt.

Sub-command: RESET (LINE_CAL -> RESET)
Help String: None
Prompt: None
Description: This sub-command sets all of the calibration arrays to 0 and reinitializes the correspondence between input data channels and positions in the calibration arrays. It is useful if a new set of line calibration data is to be applied, or a new file with different channel allocations is to be read in. The sub-command executes directly and returns to the LINE_CAL>> prompt.

Sub-command: SET (LINE_CAL -> SET)

Help 1: Enter the name of the line calibration file.
Prompt 1: Line Calibration Filename:
Help 2: Enter the channel index number.
Prompt 2: _Channel Index #:
Description: This sub-command lets the user specify a file containing line calibration data. The user is then asked which channels in the input spectrum file are to be calibrated using the data from the calibration file just read. The user can specify the channels all on a single line, separated by spaces or commas "2 4 6 7" for example, on separate lines (separated by carriage returns), or as ranges of channels (where 2 -4 indicates that all channels between 2 and 4 are to be used. Note: a separator must still appear between the preceding number and the - sign). When choosing channels, the "_Channel Index #:" prompt reappears after each carriage return. The channel entry sequence is concluded by typing only a carriage return (no numbers) at the prompt. An alternative is to enter a "^" (shift 6) at the end of the sequence. For example, "2 4 6 7 ^" will choose channels 2, 4, 6 and 7 and return to the LINE_CAL>> prompt immediately.

Command: NORM

Help String: Select the normalization to be used.
Prompt: Norm:
Description: The processing of whitening the noise spectrum in order to facilitate the detection of signals is known as normalization. Various normalization algorithms have been developed (Struzinski, 1984; Cox, 1996), each having its own method of estimating background noise. The NORM command lets the user choose which of these normalizers is to be used for trend removal (i.e., normalization), or optionally for estimating the background noise level for tracked signal peaks.

Sub-command: HARMON (NORM -> HARMON)

Help 1: Enter gap size
Prompt 1: Gap Width:
Help 2: Enter window width for noise estimation (in bins)
Prompt 1: Window_Width:
Description: This sub-command requests the harmonic mean normalizer. The user is prompted for the total length of the gap (an odd number >=1) at the centre of the split window, and the total width of the window (an even number which excludes the gap length).

Sub-command: NONE (NORM -> NONE)

Help String: None
Prompt: None
Description: This sub-command turns data normalization off. N.B.: If normalization is off, trend removal cannot be done, and line tracking will not use a normalization algorithm for estimating background noise.

Sub-command: OTA (NORM -> OTA)

Help String: Enter window width for noise estimation (in bins)
Prompt: Window_Width:
Description: This sub-command requests the Order-Truncate-Average normalizer. The user is prompted for the total length of the window (an odd number). This is not a split window normalizer, so there is no centre gap. Note that the number of bins in the input spectrum is reduced by a factor of 4 through an "ORing procedure" before the background noise estimation is performed. Background noise estimates are then interpolated to reproduce the original number of bins.

Sub-command: SAXA (NORM -> SAXA)

Help String: Enter the width of the normalizer window in bins.
Prompt: Window_Width:
Description: This sub-command requests the Split-Average-eXclude Average normalizer. The length of the gap at the centre of the split window is 5 bins. The user is prompted for the total width of the window (an even number which excludes the gap length).

Sub-command: SPLIT_WINDOW (NORM -> SPLIT_WINDOW)

Help String: Enter the width of the normalizer window in bins.
Prompt: Split-Window Normalizer Window Width:
Description: This sub-command requests the Split-Window Two-Pass normalizer. The length of the gap at the centre of the window is 5 bins. The user is prompted for the total width of the window (an even number which excludes the gap length). Note that the number of bins in the input spectrum is reduced by a factor of 4 through an "ORing procedure" before the background noise estimation is performed. Background noise estimates are then interpolated to reproduce the original number of bins.

Sub-command: TWO_PASS (NORM -> TWO_PASS)

Help String: Enter the width of the normalizer window in bins.
Prompt: Two-Pass Normalizer Window Width:
Description: This sub-command requests the Two-Pass normalizer. The user is prompted for the total width of the window (an even number). This is not a split window normalizer, so there is no centre gap. Note that the number of bins in the input spectrum is reduced by a factor of 4 through an "ORing procedure" before the background noise estimation is performed. Background noise estimates are then interpolated to reproduce the original number of bins.

N.B.: This normalizer is currently not implemented in PROPWR.

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Command: PRUN

Help String: None
Prompt: None
Description: Execute the required processing while plotting the computed 1/3 octave power levels on-screen. When processing is complete, a PLOT>> prompt appears on the user's screen, allowing the user to perform measurement operations with the on-screen data.

Sub-command: MEASURE (PRUN -> MEASURE)
Help String: None
Prompt: None
Description: Activates a cursor on the terminal screen. The current cursor X and Y values are written to the screen when any key (other then "e", "E", "x" or "X") is hit or when the left mouse button is pressed. It is useful for determining the frequencies and levels of lines within displayed spectra. Control returns to the PLOT>> prompt when an "e", "E", "x" or "X" is entered, or the right mouse button for an X terminal is pressed. At that point, any of the PRUN sub-commands can be entered.

Command: TERM

Help String: Select your terminal type
Prompt: Terminal type:
Description: This command specifies the type of graphics terminal being used. If one is using neither an X terminal nor a Tektronix compatible one, the TERM setting does not matter, but one should not use the PRUN or "TRACK -> GSET" commands.

Sub-command: KERMIT (TERM -> KERMIT)
Help String: None
Prompt: None
Description: Specifies that the MS-DOS Kermit terminal emulator is being used.

Sub-command: VERSA4014 (TERM -> VERSA4014)
Help String: None
Prompt: None
Description: Specifies that VersaTerm-PRO Tektronix 4014 terminal emulation is being used on an Apple computer.

Sub-command: VERSA4105 (TERM -> VERSA4105)
Help String: None
Prompt: None
Description: Specifies that VersaTerm-PRO Tektronix 4105 terminal emulation is being used on an Apple computer.

Sub-command: VT240 (TERM -> VT240)
Help String: None
Prompt: None
Description: Specifies that a DEC VT240/330/340 terminal or emulator is being used.

Sub-command: XTERM (TERM -> XTERM)
Help String: None
Prompt: None
Description: Specifies that an X terminal is being used.

Command: TRACK

Sub-command: GSET (TRACK -> GSET)
Help String: Choose a frame from which to pick the tracking bands.
Prompt: Set-up frame:
Description: Once six frequencies have been chosen for each line to be tracked, the user can enter an "e", "E", "x" or "X" at the keyboard (or can press the right mouse button for an X terminal) to return to the TRACK>> prompt. A "q" or "Q" entered at the keyboard will abort the selection session.

A "z" or "Z" entered at the keyboard allows one to "zoom in" to a user-specified rectangular portion of the plot. After typing "z" or "Z", move the cursor to the lower left corner of the desired area and press a key. Then move the cursor to the upper right corner of the area and again press a key. A box will be drawn around the designated area. Pressing a key will then cause the plot to "zoom in" to that area.

Sub-command: NOISE (TRACK -> NOISE)
Help String: Choose the method for estimating background noise.
Prompt: Method:
Description: Lets the user choose one of two methods for estimating the background noise level at the position of the peak within a tracking band.

Sub-sub-cmd: NORM (TRACK -> NOISE -> NORM)
Help String: None
Prompt: None
Description: The background noise level will be estimated by using the normalization method specified by the NORM command, provided that one has not specified NORM -> NONE.

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Sub-sub-cmd: TWO_BAND (TRACK -> NOISE -> TWO_BAND)

Help String: None
Prompt: None
Description: The background noise level at the peak location will be calculated by interpolating between the median noise estimates in the two noise bands on either side of the peak. This method is described on page 26 of the PROPWR manual (Farrell, 1993).

Command: TRDFILE

Help String: Enter a name for the trend removal file.
Prompt: Trend Filename:
Description: This command lets the user change the name of the output trend removal file. (See section 2. above.) The output file name defaults to the input file name with a .trd extension.

Command: TRDTYPE

Help String: Choose the method for storing the trend removal output data.
Prompt: Storage Type:
Description: Allows the user to store the trend removal data in linear or decibel (dB) format. Decibels are more commonly used.

Sub-command: DB (TRDTYPE -> DB)

Help String: None
Prompt: None
Description: Sets the storage for trend removal data to dB.

Sub-command: LINEAR (TRDTYPE -> LINEAR)

Help String: None
Prompt: None
Description: Sets the storage type for trend removal data to be linear power levels.

Command: TREND

Help String: Remove trends from spectral (i.e. normalize) (On or Off)
Prompt: Trend removal (On/Off):
Description: This command lets the user turn trend removal on or off. In any case, trend removal will not be performed if the user has entered the "NORM -> NONE" command.

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4. COMPILING AND LINKING PROPWR

Program PROPWR requires the creation of the SASIO command table subroutine PROPWR_TAB.F. This can be done by entering the following commands while in the PS_72:[CHANG.PROPWR] directory:

```
RUN [CHANG.SASIO]GENCOM
INFIL PROPWR.TAB
TERM OFF
OFIL PROPWR_TAB.F
RUN
QUIT
```

PROPWR can be compiled and linked by entering the following DCL commands from within the PS_72:[CHANG.PROPWR] directory:

```
@[CHANG.PGPLOT.AXP]DREA_LOGICAL
@MAKE_PROPWR
```

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This contractor report describes modifications made to the DREA programs PLTPWR, DISP, DISPX and PROPWR. PLTPWR is a program for plotting spectral data. The changes made to PLTPWR included correction of some program errors, the addition of the ability to display plots on an X terminal, and modification of the software so that it can operate under both the VMS and UNIX operating systems (i.e., on both DEC AXP and SGI computers).

DISP and DISPX are programs for plotting time series data. The ability to produce decibel plots was added to these programs. PROPWR is a program for processing power spectrum files. Additions made to PROPWR were the ability to display plots on an X terminal, tracking of lines whose frequency position varies with time, and other methods of estimating background noise.

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PLTPWR application
PROPWR application
DISP application
DISPX application
Signal processing software
IRIX (UNIX) operating system

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